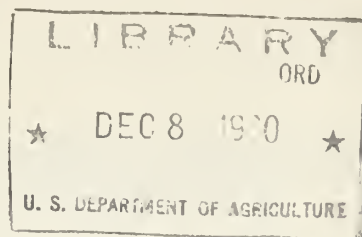


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in the coastal plain of
North Carolina

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ESTIMATING COST OF PRODUCTION ON TOBACCO-COTTON FARMS IN THE COASTAL PLAIN OF NORTH CAROLINA

By Erling Hole and James Vermeer, Agricultural Economists,
Farm Economics Research Division, U. S. Department of Agriculture

SUMMARY

Flue-cured tobacco was the major enterprise on commercial family-operated tobacco-cotton farms in the Coastal Plain of North Carolina from 1940 to 1958. Tobacco sales accounted for about 80 percent of cash receipts. On the average, approximately half of the aggregate cost of all farm enterprises was expended on tobacco, a fourth on cotton and corn, and a fourth on seven other enterprises.

From 1940 to 1958, the rate of increase in total cost of production per unit of tobacco was smaller than that of cotton, but slightly higher than that of corn. Divergent trends in yields per acre of the three commodities have affected costs significantly.

Yields of tobacco and corn have increased markedly. The trend in yield of cotton has been slightly downward, although yields of the last few years point to the beginning of an upward trend in this crop also. Efficiency of farm operators in producing tobacco, as measured by inputs (costs at constant prices), improved somewhat. The improvement was considerable for corn, but efficiency declined appreciably for cotton.

The total cost of production per unit of a commodity depends upon the assumptions made in imputing costs of operator and family labor and land or real estate capital. Several procedures and assumptions in calculating total cost per 100 pounds of tobacco produced on tobacco-cotton farms in the Coastal Plain of North Carolina were used in the study reported here (table 1).

The six procedures included in the comparison of total cost that follows are based on prevailing cost rates of production items, but each is based on a different

assumption as to yields, imputed costs of operator and family labor, and land. Procedures 1 and 2, which were used in ascertaining partial cost with prevailing and normal yield, respectively, and procedure 5, which was used to measure efficiency in production, are omitted for purposes of this comparison.

The method in procedure 3 charged operator and family labor at current wage rates of hired labor, and land at current values times current interest rates.

Under procedure 4, normal yield was substituted for prevailing yield.

Procedure 6 differed from procedures 3 and 4 in that labor and land were charged at the 1947-49 average wage rate, land value, and interest rates.

Under procedure 7, operator and family labor was charged at the average rate of return earned in 1947-49, but the assumptions regarding land were the same as in procedure 6.

Procedure 8 consists of the average rate of return in 1947-49 adjusted for changes in prices paid for commodities used in farm family living, with land charged at the 1947-49 rate.

The estimate of cost of producing tobacco in procedure 9 is derived from the aggregate cost of all farm enterprises, assuming prevailing yield and cost rates, with operator and family labor charged at current wage rates of hired labor and land charged at current values times current interest rates, less the combined value of all commodities produced other than tobacco.

Total cost of producing tobacco, in dollars per 100 pounds, calculated in accord-

TABLE 1.--Farm product costs: Procedures used in calculations of cost per unit, tobacco-cotton farms, Coastal Plain, North Carolina, 1940-58

Procedure		Kind of cost	Crop yield per acre	Cost rates of production items			Calculations of cost	
Number	Based on			All items except two ¹	Operator and family labor	Land	Number of calculations	Commodity
1	Enterprise	Operating	Prevailing	Prevailing	Not included	Not included	3	Tobacco, cotton, and corn.
2	do.	do.	Normal	do.	do.	do.	3	Do.
3	do.	Total	Prevailing	do.	Prevailing wage rates of hired labor	Prevailing values of land and rates of interest	10	Tobacco, cotton, corn, wheat, oats, soybeans, hay, milk, hogs, and eggs.
4	do.	do.	Normal	do.	do.	do.	3	Tobacco, cotton, and corn.
5	do.	do.	Prevailing	1947-49 average	1947-49 average wage rate of hired labor	1947-49 average value of land and rate of interest	10	Tobacco, cotton, corn, wheat, oats, soybeans, hay, milk, hogs, and eggs.
6	do.	do.	Normal	Prevailing	do.	do.	1	Tobacco.
7	do.	do.	do.	do.	1947-49 average rate of return	do.	1	Do.
8	do.	do.	do.	do.	1947-49 average of return adjusted for changes in prices paid for all commodities used in farm family living	do.	1	Do.
9	Residual ²	do.	Prevailing	do.	Prevailing wage rates of hired labor	Prevailing values of land and rates of interest	1	Do.
Total number of calculations.....							33	

¹ Except charges for operator and family labor and for land.

² Aggregate cost of all farm enterprises minus value of the product of enterprises other than tobacco divided by production of tobacco.

ance with these procedures and assumptions was as follows:

<u>Procedure</u>	<u>1940</u>	<u>1949</u>	<u>1958</u>
	Dollars	Dollars	Dollars
3	14.71	32.93	39.99
4	16.66	31.92	42.90
6	28.75	31.64	37.58
7	37.09	38.23	43.56
8	25.42	38.23	46.50
9	17.70	39.26	51.90

Total costs of producing cotton and corn were calculated according to procedures 3 and 4 as stated for tobacco. The total cost

of producing cotton, in cents per pound of lint, was:

<u>Procedure</u>	<u>1940</u>	<u>1949</u>	<u>1958</u>
	Cents	Cents	Cents
3	8.0	41.1	34.1
4	9.7	27.1	45.3

The total cost of producing corn, in dollars per bushel, was as follows:

<u>Procedure</u>	<u>1940</u>	<u>1949</u>	<u>1958</u>
	Dollars	Dollars	Dollars
3	1.20	1.58	1.93
4	1.17	2.01	2.27

INTRODUCTION

Costs of production of agricultural commodities are of general interest to farmers and farm-management specialists on the one hand, and to farm leaders and administrators of farm programs on the other. These two groups use information on costs for different purposes. They place dissimilar demands on the adequacy of information on costs. Farmers and farm-management specialists, who use data on costs as an aid in choosing the most profitable farm organization, could make good use of data on partial costs. Farm leaders and administrators of farm programs, who use data on costs for the purpose of comparing them with market prices, require full information on costs.

The difference between partial and full costs consists chiefly of operator and family labor, and land. These costs are the controversial issues in the computation of full cost. A common type of partial cost found in farm-management literature is operating cost, which does not include allowances for operator and family labor or land. It is only with the inclusion of these items of production that the cost of a commodity qualifies as full or total cost.

Although costs of operator and family labor and land can be imputed, the resulting total cost cannot be labeled the total cost. Rather, one obtains a number of total costs, each of which depends on the particular procedure and assumptions used. Anyone who uses total cost figures should choose the total cost ascertained by the procedure and assumptions most suitable for the intended purpose. If, for example,

one is interested in total costs each year due to changes in costs of factors other than charges for land and operator and family labor, procedure 7 should be used. If, in addition, one is interested in the effect that higher living costs would have on total costs, procedure 8 should be used. Each of the other procedures is based on specific assumptions. Many other assumptions could have been made, but these examples illustrate that no one cost estimate can serve all purposes.

Total cost of production of a farm commodity--especially the major commodity--can be calculated by two different procedures. One method distributes all items of cost among the various enterprises. The other starts from the aggregate cost and deducts the value of all other commodities produced on the farm.

Distributing costs among the various enterprises on a farm raises several questions because of the combination of enterprises on farms. Minor or supplementary enterprises are usually engaged in by farmers, even though returns of such enterprises do not cover all imputed costs of inputs valued at market prices. The reason is that they use resources which have little or no opportunity cost or which would be wasted otherwise. Also, enterprises may complement each other.

The procedure that starts with aggregate cost bypasses the detailed dividing of items of cost among the several enterprises. It is therefore immune from any criticism of the distribution of costs as such. But the

deriving of the total cost of a particular commodity from aggregate cost assumes that the cost of producing all other commodities is equal to their value.

This method of computing the total cost of producing a particular commodity is valid only if the enterprise in question is the major enterprise in the farm organization.

In general, technological changes in farming have been associated with an ever-increasing proportion of production items bought from nonfarm sources. To the extent to which this has occurred, it has been a

gain in the accuracy of estimates of cost. The cost of operating a tractor, for example, can be ascertained more accurately than the cost of maintaining a mule.

Calculations of costs of production can serve a variety of useful purposes. But they place rigorous demands upon the researcher to state their limitations and the procedure and assumptions upon which each is based. The user of such calculations needs to familiarize himself with the assumptions so he can select the calculation that best meets his objective and purpose.

PURPOSE AND METHOD OF STUDY

The broad purpose of the study reported was to ascertain changes in total costs of production of major agricultural commodities produced on farms in the Coastal Plain of North Carolina. The need to inquire into methods arises from the several procedures and assumptions that can be used in imputing costs to operator and family labor, and land.

The specific purposes of the study were to: (1) Compare changes in costs of producing flue-cured tobacco, which was the only type of tobacco produced on the farms, with those of cotton and other commodities produced on tobacco-cotton farms in the Coastal Plain of North Carolina from 1940 to 1958; and (2) examine the effects of methods used to estimate costs of production and several bases for evaluating operator and family labor and land.

The costs and returns series for average commercial family-operated tobacco-cotton farms in the Coastal Plain of North Carolina, which are based on a labor organization consisting of an owner-operator and one cropper, furnished most of the data required for the analysis.¹ The chief source was the unpublished data used in these series. Some information was obtained also from publications of the North Carolina Agricultural Experiment Station.

In the cost analyses reported, two principal approaches were made to the problem of ascertaining the cost of production of a

farm commodity. Costs were first distributed by enterprises, and the per unit cost was calculated for each commodity produced on the farm. Most of the analyses of both operating and total costs are based on this approach. The total cost of producing tobacco, the major commodity on these farms, was then calculated by subtracting from the aggregate farm cost the value of products of all supplementary enterprises, which were assumed to be equal to their cost. An outline of procedures and assumptions used in the various computations of costs and of the commodities concerned is given in table 1.

As used in the study reported, cost refers to operator's cost per unit of production. It represents the cost the operator incurs per unit of that part of the total production of a commodity which redounds to him as a result of operations for his own account and of those shared with the cropper. In obtaining the operator's cost, the cropper's shares of production and expenses, as well as the cropper's labor on operations he shared with the operator, are deducted from farm totals. Although the cropper's share of the crop was deducted, the cost of privileges including a house furnished the cropper is a part of operator's cost.

In farm-management decisions, the operator's cost is strategic. It is more meaningful than the cost per unit of the entire production of a commodity on a farm with enterprises shared between operator and cropper. To ascertain the latter cost would include "cost of cropper labor." According to conventional farm accounting, this item is the value of cropper's share of production at current market prices minus his

¹ Information on these farms is given in N. C. Agr. Expt. Sta. A. E. Inform. Ser. 47, and this series is included in the following USDA publications: Agr. Inform. Bul. 176, revised August 1959 (1955-58), Agr. Inform. Bul. 158 (1952-54), and Statis. Bul. 197 (1940-51).

share of expenses. To impute the cost of cropper labor by applying wage rates of hired labor or other assumed rates to hours of labor furnished by the cropper would be a tenable procedure. It would be an acceptable alternative to the procedures used in the study reported.

The operating cost of a commodity consists of operator's costs of all production items including an interest charge on working capital, but excepting a value of operator and family labor and an interest charge on land. The total cost includes also the operator's imputed costs of these two items (table 1). As used in this report, the term "land" includes the value of both land and buildings. It is synonymous with real estate capital. The imputed cost of land refers solely to that part of the cost represented by the interest charge for real estate capital. Other costs of real estate, such as depreciation of buildings, maintenance, and taxes, are included in the operating cost.

To charge the cost of real estate capital to enterprises in proportion to the value of land and buildings used, separate estimates were made for value of cropland, pasture, woodland, operator's dwelling, cropper's house, tobacco barns and packing houses, and other service buildings.

In general, inputs were charged to all enterprises at uniform rates. Hence, the cost of operator and family labor was the same per hour whether or not this labor was used on the tobacco or any other enterprise. Also, the charge per acre for use of cropland was the same whether the land was used for tobacco or for another crop. Although this method is not altogether satisfactory, information required for another rationale of distribution is not available. Yet, other alternatives are conceivable. These alternatives would be based on differential instead of uniform cost rates.

The number of hours of work was the criterion for distributing the cost of farm machinery and of mules. The cost of service buildings other than tobacco barns and packing houses were distributed in proportion to the estimated space occupied by the various enterprises. The number of man-hours of direct labor on the various enterprises was used as a criterion in dividing the cost of management. In calculating the

cost of management, the wage rate per hour of operator's time used for management was 50 percent greater than that used for regular farmwork. Management is included with operator and family labor. Overhead labor other than management was charged to land, building, and machinery maintenance at wage rates for regular farmwork. The cost of cropper privileges including housing was distributed on the basis of the number of hours of labor furnished by the cropper on enterprises he and the operator shared.

Operator's privileges including dwelling were not a part of the costs of production. This procedure was necessary in view of assuming wage rates of hired labor without board or room as compensation for operator and family labor.

In computing cost of producing tobacco, selling charges are not included as these charges are largely a percentage of value. Prices received by growers for tobacco, as used in this report, are net prices after selling charges are deducted. The cost of producing cotton per pound of lint was computed by subtracting the market value of cottonseed from total cost and dividing by production of cotton. Similarly, credits for beef, veal, and poultry meat were allowed in calculating the cost of producing milk and eggs, respectively.

Aggregate cost is the operator's combined cost of all farm enterprises. It falls short of total (farm) cost used in the costs and returns series because the value of items included in aggregate cost, such as homegrown feed and seed used in production, is smaller than the value of items excluded, such as cost of cropper labor. Aggregate cost includes total cash expenditures adjusted for changes in inventory of buildings and machinery plus value of homegrown feed and seed used on the farm valued at market prices, cash wages paid the cropper for day labor, value of operator and family labor, and charge for capital, minus cost of cropper labor, cropper expense, and value of items that were not a part of the costs of production, such as operator's dwelling.

Unless otherwise specified, the total cost of production of a commodity and total input are based on procedures 3 and 5, respectively, as outlined in table 1.

FARM AND COMMODITY COSTS

Because of the importance of the tobacco enterprise, the indexes of total cost per unit of production for the farm as a whole, and for the tobacco enterprise corresponded closely from 1940 to 1958 (table 2). Sales of tobacco increased from 63 percent of total receipts in 1940 to 85 percent in 1945. Since that time, they have averaged about 80 percent.

The total cost of production per unit almost doubled between 1940 and 1945 and has continued to increase, although at a reduced rate. The chief factor influencing a rising trend in cost has been an increase in prices of production items. Increases in yield per acre of tobacco have tempered those in cost rates.

In 1956-58, wage rates were 3.5 times the 1940-42 rates. Total value of land and buildings on these farms were 3.2 times these rates; and value of land and buildings per acre of tobacco, 3.5 times. Total sales

of tobacco were 2.8 times, tobacco sales per acre of tobacco, 3.0 times, and prices of tobacco, 1.9 times the 1940-42 rates. The relative rise in cost factors from 1940-42 to 1956-58 exceeded that of income factors.

From 1940-42 to 1956-58, the total cost of producing tobacco increased 136 percent (table 3). The increase was smaller for corn, hogs, and soybeans, but greater for each of the other six commodities produced on tobacco-cotton farms.

Input (total cost at 1947-49 prices) per unit of production, which is a measure of efficiency, has shown a somewhat erratic, although moderately downward, trend. Contributing to this trend has been an increase in production per man-hour. One man-hour of labor produced 2.3 pounds of tobacco in 1940-42, whereas in 1956-58, it produced 3.2 pounds.

TABLE 2. --Farm, and tobacco enterprise: Total costs and total inputs, per unit of production, tobacco-cotton farms, Coastal Plain, North Carolina, 1940-58

(Index numbers, 1947-49=100)

Year	Total costs		Total inputs ¹	
	Whole farm	Tobacco enterprise	Whole farm	Tobacco enterprise
1940.....	42	46	104	106
1941.....	55	57	116	121
1942.....	60	56	104	104
1943.....	75	76	115	120
1944.....	74	73	100	102
1945.....	83	82	105	104
1946.....	90	86	99	98
1947.....	94	96	98	98
1948.....	101	100	98	100
1949.....	105	104	104	102
1950.....	109	97	102	94
1951.....	107	100	90	90
1952.....	120	121	101	103
1953.....	125	123	104	102
1954.....	129	132	107	110
1955.....	112	109	93	90
1956.....	109	109	88	87
1957.....	137	140	108	109
1958.....	127	126	94	96

¹ Total costs at 1947-49 cost rates.

TABLE 3.--Farm commodities: Total costs and total inputs per unit of production in 1956-58 as a percentage of 1940-42, tobacco-cotton farms, Coastal Plain, North Carolina

Kind of commodity	1956-58 as a percentage of 1940-42		Kind of commodity	1956-58 as a percentage of 1940-42	
	Total costs	Total inputs ¹		Total costs	Total inputs ¹
	Percent	Percent		Percent	Percent
Tobacco.....	236	82	Soybeans.....	155	58
Cotton.....	428	129	Hay.....	315	131
Corn.....	161	62	Milk.....	310	111
Wheat.....	274	103	Hogs.....	197	109
Oats.....	284	109	Eggs.....	320	127

¹ Total costs at 1947-49 cost rates.

On the basis of input per unit of production, the gain in efficiency of producing tobacco was exceeded only by that of corn

and soybeans. Production of the other seven commodities was less efficient in 1956-58 than in 1940-42.

COSTS OF PRODUCING TOBACCO, COTTON, AND CORN

Yields per Acre and Production Practices

Yield per acre, as it affects volume of production, directly influences cost of production per unit both from the standpoint of differences in cost from year to year as well as in changes over a longer period of time. Prevailing and normal yields of tobacco, cotton, and corn are shown in table 4. Normal yield is the average yield from 1940 to 1958 adjusted for straight-line trend calculated by the method of least squares.

Tobacco

Yields of tobacco have trended upward, with only moderate annual deviations from normal. At the end of the period, there was no indication that the upward trend was coming to a halt or that the annual rate of increase was diminishing. The tobacco program, which has been continuously in effect since 1940, has no doubt raised the rate of adoption of practices engendering increases in yield. Higher yields, accompanied by reductions in cost per pound of leaf tobacco produced, enabled growers to obtain greater returns per acre.

The change in average yield of tobacco, input of selected production items used per acre, and production per hour of labor were as follows:

	1940-42	1956-58
Yield.....pounds.....	1,063	1,672
Plantbed materials ...dollars ¹	10.27	15.10
Fertilizerpounds.....	1,017	1,383
Fumigants and insecticidesdollars ¹	1.67	7.82
Curing oilgallons.....	29	245
Man laborhours.....	467	518
Mule work.....do.....	80	40
Tractor work..do.....	0	10.2
Tobacco produced per hour of laborpounds.....	2.3	3.2

¹ Fumigants valued at 1956-58 average prices, other materials at 1947-49 prices.

The increase in input of plantbed materials is accounted for largely by the use of methyl bromide and similar chemicals to sterilize the beds. The practice of fumigating tobacco land for nematode control has increased rapidly in recent years.

The quantity of fertilizer used increased considerably, but the increase in plant nutrients was even greater as 3-9-9 and

TABLE 4.--Tobacco, cotton, and corn: Prevailing and normal yields per acre, tobacco-cotton farms, Coastal Plain, North Carolina, 1940-58¹

Year	Tobacco		Cotton		Corn	
	Prevailing	Normal	Prevailing	Normal	Prevailing	Normal
	<u>Pounds</u>	<u>Pounds</u>	<u>Pounds</u>	<u>Pounds</u>	<u>Bushels</u>	<u>Bushels</u>
1940.....	1,105	969	442	371	19.2	19.7
1941.....	967	1,005	355	370	22.3	20.6
1942.....	1,116	1,042	427	369	18.9	21.6
1943.....	957	1,078	326	368	22.0	22.6
1944.....	1,116	1,115	466	366	20.7	23.6
1945.....	1,122	1,151	293	365	25.1	24.6
1946.....	1,198	1,188	307	364	27.2	25.5
1947.....	1,215	1,225	307	363	32.1	26.5
1948.....	1,300	1,261	468	362	27.1	27.5
1949.....	1,256	1,298	241	361	36.1	28.5
1950.....	1,406	1,334	108	359	33.7	29.5
1951.....	1,422	1,371	377	358	31.2	30.4
1952.....	1,254	1,407	371	357	23.0	31.4
1953.....	1,298	1,444	252	356	26.9	32.4
1954.....	1,348	1,480	333	355	20.9	33.4
1955.....	1,560	1,517	290	354	33.0	34.4
1956.....	1,745	1,553	407	352	42.7	35.3
1957.....	1,490	1,590	340	351	34.0	36.3
1958.....	1,780	1,627	490	350	45.0	37.3

¹ Normal yield is the 1940-58 average adjusted for straight-line trend calculated by the method of least squares; the abnormally low yield of cotton in 1950 was omitted.

4-8-10 fertilizer gradually supplanted 3-9-6.

One of the greatest changes in tobacco production during the last 19 years has been in curing. Use of kerosene, fuel oil, gas, or coal has all but eliminated the use of wood for curing. Although the number of hours of man labor used per acre of tobacco has increased, the increase has been small relative to the higher yield of tobacco. Such labor-saving devices as substitution of tractor power for mule power and use of tobacco harvesters since 1954 have contributed to a higher production per man-hour in 1956-58 than in 1940-42.

Cotton

Apart from considerable variation in the yield of cotton from year to year, the trend for the 19-year period was slightly downward. Although weather and insect infestations have affected the yield of cotton, the lower yield is also a reflection of growers' lack of attention to the crop. Tobacco--the

major cash crop on these farms--has received the growers' chief attention. There are indications, however, that in the last few years, as a result of reduced income from tobacco sales, growers have paid more attention to cotton than formerly. Since 1953, the yield of cotton has been rising.

The change in average yield of cotton, input of selected production items used per acre, and production per hour of labor were as follows:

	<u>1940-42</u>	<u>1956-58</u>
Yield of lint pounds	408	412
Fertilizer..... pounds	440	550
Insecticides dollars ¹ ..	0	2.00
Man labor..... hours.....	127	128
Mule work.....do.....	38	10
Tractor work....do.....	0	7
Cotton produced per hour of labor pounds	3.2	3.2

¹Insecticides valued at 1956-58 average prices.

The increase in quantity of fertilizer used was accompanied by a shift from 4-10-6 to fertilizer with a higher content of plant nutrients, such as 5-10-10 with additional nitrogen for sidedressing. Application of insecticides has become common in recent years. Production per man-hour of labor was about the same in 1956-58 as in 1940-42.

Corn

The longtime increase in the yield of corn has been upward, although deviations from the normal yield have been considerable in recent years. The yield has doubled since 1940.

The change in average yield of corn, input of selected production items used per acre, and production per hour of labor were as follows:

	<u>1940-42</u>	<u>1956-58</u>
Yield bushels ...	20.1	40.6
Hybrid seed pounds	0	7
Fertilizer pounds	208	525
Man labor hours 41		29
Mule work do 39		10
Tractor work do 0		7
Corn produced per hour of labor bushels5	1.4

Along with expansion of planting of hybrid seed to 85 percent of the acreage planted in 1958, use of fertilizer increased also. The substitution of tractor power for mule power and of mechanical for hand picking of corn contributed to a reduction in labor per acre and to a much greater production per hour of labor in 1956-58 than in 1940-42.

Operating and Total Costs

Operating and total costs per unit of production were calculated for tobacco, cotton, and corn at prevailing cost rates, and with prevailing and normal yields (tables 5 and 6). The effect on costs of assuming normal yield is to smooth out annual fluctuations as effects of changes in the yield from year to year are reduced.

In general, operating cost per unit of production, assuming normal yield, in-

creased relatively more for cotton than for tobacco and corn from 1940 to 1958. Also, operating cost for the latter two crops tended to increase at a relatively even rate throughout the period, whereas that for cotton rose rapidly from 1940 to 1945 and more slowly since that time. Operating cost includes charges for all materials and services used in production except for operator and family labor including management and land.

To arrive at total cost from operating cost, it is necessary to add to operating cost charges for operator and family labor, and for land. The charges for these services depend upon the procedure and assumptions used. Ordinarily, returns to them are considered either as an indivisible amount, or the return to each is estimated by assuming a return to one of them and thereby establishing the other as the residual claimant.

As our immediate objective is to analyze divergent trends in total costs, and relationships between total cost and operating cost for tobacco, cotton, and corn, according to selected procedures and assumptions, it is essential that these costs be calculated according to the same procedures and assumptions for all three crops. The cost of operator and family labor used in this analysis was based on current wage rates of hired labor, and the cost of land (land and buildings) was based on current values of land and rates of interest on farm mortgages. Using these assumptions, the total costs were ascertained for prevailing as well as for normal yields (table 1, procedures 3 and 4).

The longtime increases in total cost of production per unit of cotton, assuming a normal yield, have been greater than increases in costs of tobacco and corn (fig. 1). The same observation was made for operating cost. The total cost of producing cotton in 1958 was approximately 4.5 times the cost in 1940, whereas it was 2.5 times for tobacco and nearly 2 times for corn. The divergent trends in costs have altered the comparative advantage of these enterprises.

The year-to-year effect of a change in yield on total cost of production is demonstrated by tobacco (tables 4 and 5). In 1954, the total cost of producing tobacco, which had been going up almost without interruption since 1940, came to a climax at \$41.56 per 100 pounds. Because of the

TABLE 5. --Tobacco: Operating cost and total cost of production, at prevailing cost rates, tobacco-cotton farms, Coastal Plain, North Carolina, 1940-58

Year	Cost per 100 pounds of tobacco			
	Operating cost with--		Total cost with--	
	Prevailing yield	Normal yield	Prevailing yield	Normal yield
	<u>Dollars</u>	<u>Dollars</u>	<u>Dollars</u>	<u>Dollars</u>
1940.....	9.35	10.62	14.71	16.66
1941.....	11.24	10.83	17.90	17.26
1942.....	10.79	11.53	17.74	18.93
1943.....	14.15	12.62	24.07	21.54
1944.....	13.02	13.04	23.11	23.18
1945.....	14.13	13.81	25.83	25.30
1946.....	14.66	14.80	27.25	27.56
1947.....	16.27	16.13	30.33	30.04
1948.....	17.48	17.98	31.54	32.35
1949.....	18.39	17.82	32.93	31.92
1950.....	17.12	18.02	30.57	32.11
1951.....	17.46	18.10	31.61	32.65
1952.....	21.18	18.98	38.19	34.24
1953.....	21.68	19.68	38.76	35.39
1954.....	24.66	22.66	41.56	38.27
1955.....	19.29	19.81	34.48	35.59
1956.....	19.22	21.35	34.51	38.21
1957.....	25.37	23.50	44.34	42.11
1958.....	22.66	25.37	39.99	42.90

higher yield in the following year (1955), total cost declined to \$34.48. The still higher yield in 1956, however, failed to reduce cost per unit further because prices of most production items had risen. The lower yield in 1957 caused total cost to rise about \$10 per 100 pounds to \$44.34, a record high for the period. In 1958, the cost declined in response to an exceptionally large increase in the yield.

The cost gap, or the imputed costs of operator and family labor and of land, is of considerable magnitude. It is about 45 percent of the total cost for tobacco, somewhat smaller for corn, but perceptibly larger for cotton (fig. 2). Apart from annual variations, the ratio of imputed costs of operator and family labor, and land to total cost for each of the three crops under consideration expresses no noteworthy trend.

Inputs

Although the previous analysis of total cost at prevailing prices per unit of produc-

tion enabled us to reach some preliminary conclusions relating to the competitive position in farm organization of the three enterprises under study, another measure of comparison is afforded by an analysis of input, or total cost at constant prices per unit of production. This is a measure of efficiency.

The constant prices of production items used in this analysis are the averages for the 3 years 1947-49 (table 1, procedure 5). The imputed cost of operator and family labor was based on average wage rates of hired labor during these years and similarly the cost of land was based on average land values and rates of interest. The choice of 1947-49 was chiefly one of convenience. However, there is no indication that any other period would have served the purpose better.

As the prevailing yield was used as the measure of production, this analysis was based on a 3-year moving average centered in order to reduce the effects of sharp

TABLE 6.--Cotton and corn: Operating cost and total cost of production, at prevailing cost rates, tobacco-cotton farms, Coastal Plain, North Carolina, 1940-58

Year	Cost per pound of cotton			Cost per bushel of corn		
	Operating cost with--		Total cost with--	Operating cost with--		Total cost with--
	Prevailing yield	Normal yield	Prevailing yield	Prevailing yield	Normal yield	Prevailing yield
	Cents	Cents	Cents	Dollars	Dollars	Dollars
1940.....	3.92	4.85	8.02	0.70	0.69	1.20
1941.....	3.60	3.38	8.85	.63	.68	1.11
1942.....	3.87	4.89	9.28	.86	.76	1.48
1943.....	6.82	5.77	15.09	.88	.85	1.51
1944.....	4.78	6.88	12.07	1.09	.95	1.83
1945.....	10.46	8.11	23.21	.98	1.00	1.67
1946.....	9.72	7.62	23.87	1.08	1.15	1.83
1947.....	10.36	10.36	26.26	.99	1.21	1.69
1948.....	8.16	11.40	19.64	1.23	1.21	2.08
1949.....	19.90	12.81	41.08	.95	1.21	1.58
1950.....	46.35	10.94	92.21	1.08	1.24	1.80
1951.....	11.96	12.83	26.79	1.20	1.24	2.00
1952.....	13.30	14.06	29.46	1.69	1.25	2.85
1953.....	22.62	15.50	47.11	1.47	1.22	2.49
1954.....	17.87	16.60	37.25	2.01	1.26	3.34
1955.....	20.97	17.22	42.55	1.25	1.20	2.14
1956.....	16.18	18.66	34.14	1.02	1.19	1.79
1957.....	20.97	20.23	43.81	1.37	1.28	2.40
1958.....	15.84	22.15	34.07	1.07	1.28	1.93

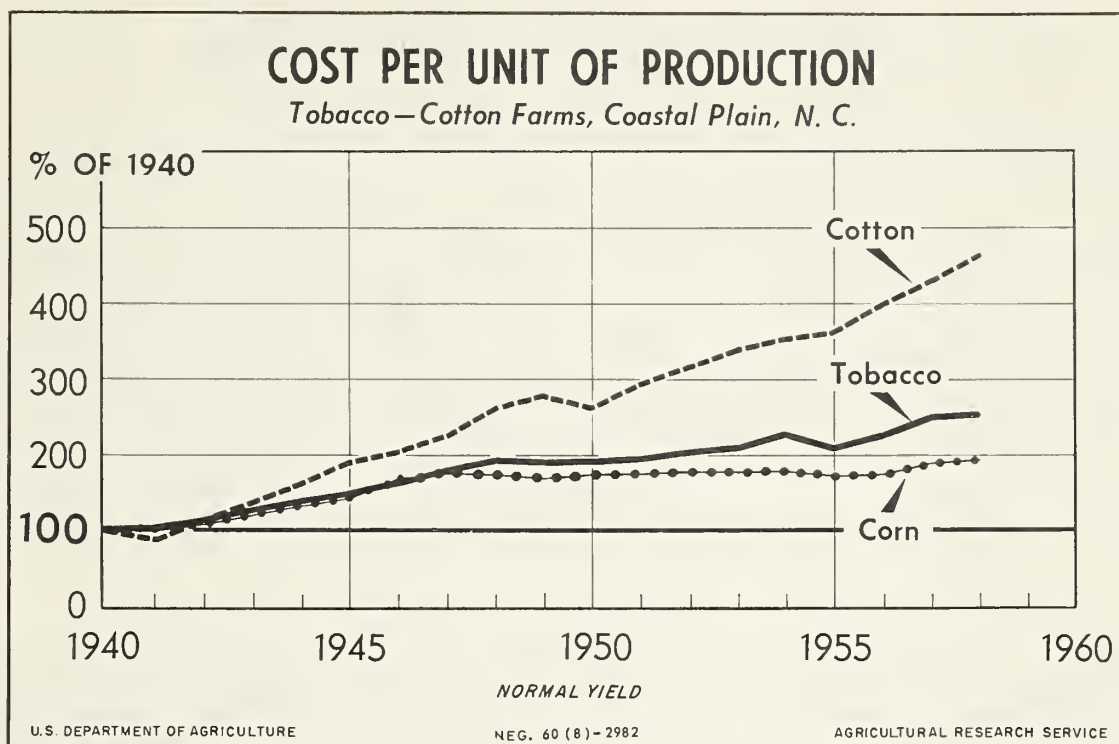


Figure 1

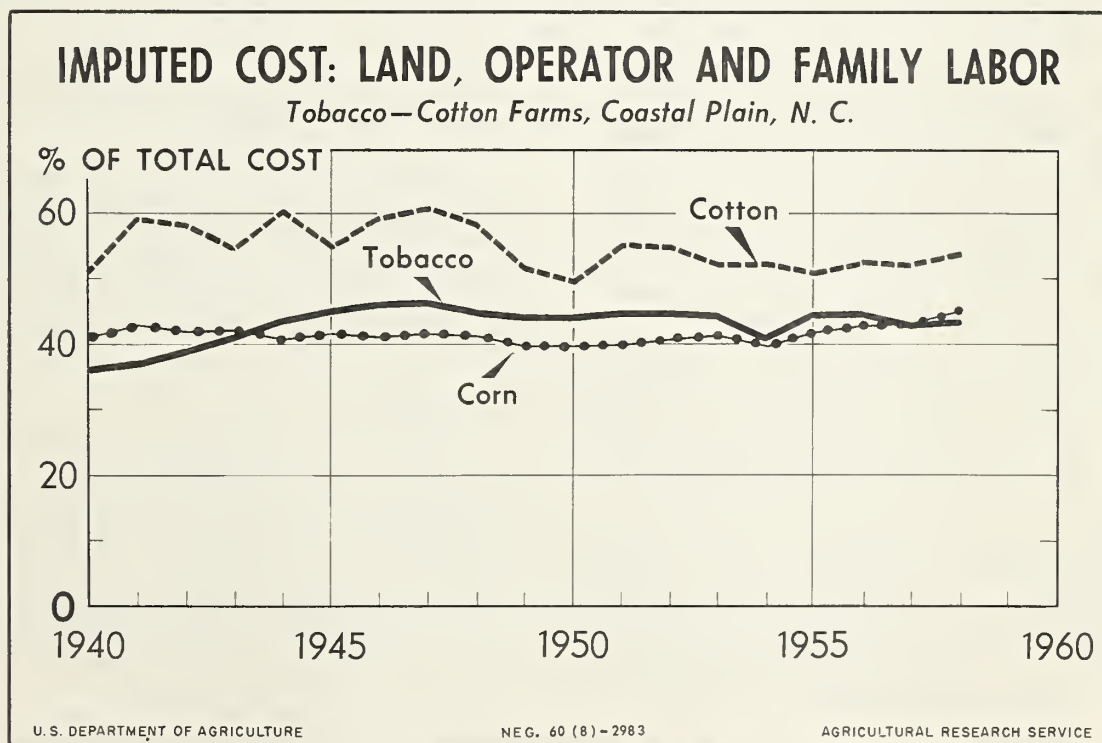


Figure 2

INPUT PER UNIT OF PRODUCTION

Tobacco—Cotton Farms, Coastal Plain, N. C.

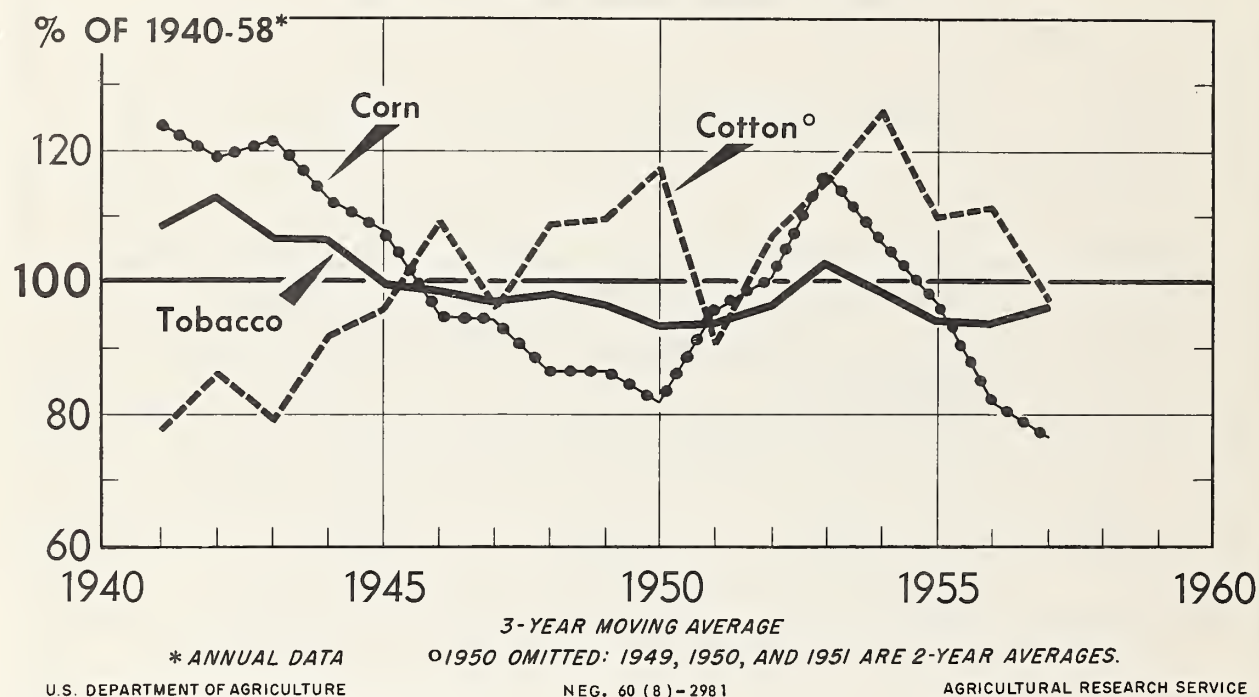


Figure 3

annual oscillations in the yield. Thus, the observations began in 1941 and ended in 1957.

The broad swings in input per unit of tobacco and corn showed the same general pattern, although they were greater for corn than for tobacco (fig. 3). Input per unit of cotton took a course opposite to that of tobacco and corn from 1941 to 1950 and a vacillating one since that time. As the period ended, inputs per unit of tobacco and cotton were slightly below the 17-year average, whereas that of corn was substantially below.

Efficiency in production of corn has improved markedly during this period, and that of tobacco has increased to some extent. By and large, however, production of cotton has become less efficient, although the changes in recent years may mean that recovery of lost ground is starting.

Total Costs, and Prices Received by Farmers

Before comparing total costs of production of tobacco, cotton, and corn with prices received by farmers for these commodities, it is imperative to marshall the procedures and assumptions on which computations of total costs were based. First, prevailing prices of production items were used; costs of operator and family labor were imputed by assuming current wage rates of hired labor; and cost of land, by assuming current values of land (and buildings) and rates of interest. Second, prevailing yields were used. And third, cost rates of all factors of production were applied uniformly to all enterprises. For example, an hour of family labor was charged at the same rate whether used on tobacco or on corn, and similarly, an acre of cropland was charged at the same rate for corn as for tobacco.

In each of the 19 years from 1940 through 1958, prices received for tobacco, less selling charges, exceeded total cost per unit, as here calculated (table 1, procedure 3), by a considerable margin each year. The price of cotton exceeded cost in 12 years, but fell short of it in 7 of the last 10 years of the period. The cost of producing corn was greater than the price received for corn sold in all years except 1947 (table 7). In general, costs of producing other commodities on the farm were higher than the prices received by farmers from the sale of these products.

The distribution of cost by enterprises reveals that the percentage of aggregate cost charged to tobacco has been gaining, whereas that of cotton has declined (table

8). In the last 2 years, however, a contraction in production of both tobacco and cotton was offset by an expansion in production of corn and hogs. The cost of producing tobacco, which accounted for 44.2 percent of aggregate cost in 1940, had expanded to 53.2 percent in 1955; by 1958, it had receded to 46.3 percent. The corresponding percentage for cotton declined from 14.2 percent in 1940 to 9.0 in 1955 and to 8.6 in 1958. The cost of producing corn was 17.9 percent of the aggregate cost in 1958 compared with 15.9 percent in 1955. The percentage that the seven other commodities as a group made up of the aggregate cost increased from 21.9 percent in 1955 to 27.2 percent in 1958. The higher figure in 1958 reflected chiefly an expansion in hog production.

TOTAL COST OF PRODUCING TOBACCO FURTHER CONSIDERED

The analyses pursued up to this point have resulted in calculations, based on certain procedures and assumptions, of both operating and total costs per unit of producing tobacco, cotton, and corn. The rest of this report is intended as an example of the effects of specified procedures and assumptions on the total cost of producing tobacco. With prevailing yield and prevailing cost rates, the total cost increased from \$14.71 per 100 pounds of tobacco in 1940 to \$39.99 in 1958 (table 5), and substituting normal yield for prevailing yield, the total cost increased from \$16.66 per 100 pounds in 1940 to \$42.90 in 1958. In both these calculations, costs of operator and family labor were imputed by assuming current wage rates of hired labor and cost of land by assuming current values of land and rates of interest.

Enterprise Cost Under Different Assumptions

In testing the effects of making different assumptions regarding costs of operator and family labor, and land, normal yield and prevailing cost rates are used for all production items other than operator and family labor, and land (table 9).

Procedure 6: The first change in assumptions is to charge operator and family labor at the average wage rate of hired labor obtaining in 1947-49, and to charge land according to the average value of land

and rate of interest for the same years. Under these assumptions, the total cost of producing tobacco ranged from \$28.75 per 100 pounds in 1940 to \$37.58 in 1958.

Procedure 7: Similarly, by retaining the assumption for land, but substituting the average rate of return in 1947-49 for the average wage rate, the total cost of producing tobacco ranged from \$37.09 per 100 pounds in 1940 to \$43.56 in 1958.

Procedure 8: Finally, by adjusting the average rate of return to operator and family labor in 1947-49 for changes in prices of all commodities used in farm family living, the total cost of producing tobacco ranged from \$25.42 per 100 pounds in 1940 to \$46.50 in 1958.

If operator and family labor, and land had been charged at the 1947-49 average level of wage rates, values of land, and rates of interest, respectively (procedure 6), the total cost of producing tobacco in the beginning of the period 1940-58 would have been higher. Toward the end of the period, the cost would have been lower, as compared with the cost at prevailing rates for these items. The same effect, although more pronounced, is observed when the 1947-49 average rate of return to operator and family labor is used (procedure 7).

By adjusting the average rate of return in 1947-49 to maintain the purchasing power of earnings in 1947-49 (procedure 8), the total cost of producing tobacco compared

TABLE 7.--Tobacco, cotton, and corn: Prices received by farmers as a percentage of total cost per unit of production, tobacco-cotton farms, Coastal Plain, North Carolina, 1940-58

Year	Tobacco	Cotton	Corn	Year	Tobacco	Cotton	Corn
	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>		<u>Percent</u>	<u>Percent</u>	<u>Percent</u>
1940.....	110	128	55	1950.....	179	46	79
1941.....	162	208	68	1951.....	170	152	80
1942.....	210	213	77	1952.....	128	125	58
1943.....	162	140	97	1953.....	139	72	61
1944.....	181	178	78	1954.....	128	97	71
1945.....	165	103	82	1955.....	150	78	59
1946.....	182	141	94	1956.....	146	94	70
1947.....	138	128	112	1957.....	120	73	52
1948.....	152	162	60	1958.....	139	103	65
1949.....	144	74	76				

TABLE 8.--Combination of enterprises: Distribution of aggregate cost by enterprises, tobacco-cotton farms, Coastal Plain, North Carolina, 1940-58

Year	Tobacco	Cotton	Corn	Other	Total
	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>
1940.....	44.2	14.2	18.6	23.0	100.0
1941.....	44.1	12.9	18.1	24.9	100.0
1942.....	43.5	13.6	16.2	26.7	100.0
1943.....	45.1	12.5	15.5	26.9	100.0
1944.....	49.5	12.3	14.3	23.9	100.0
1945.....	52.5	10.9	14.7	21.9	100.0
1946.....	54.0	9.8	14.5	21.7	100.0
1947.....	52.9	10.5	14.0	22.6	100.0
1948.....	46.9	14.2	16.1	22.8	100.0
1949.....	48.9	14.4	15.8	20.9	100.0
1950.....	50.7	9.4	17.0	22.9	100.0
1951.....	51.5	12.5	14.6	21.4	100.0
1952.....	51.3	12.2	14.5	22.0	100.0
1953.....	50.8	13.0	15.3	20.9	100.0
1954.....	53.2	9.7	14.7	22.4	100.0
1955.....	53.2	9.0	15.9	21.9	100.0
1956.....	51.1	9.3	16.1	23.5	100.0
1957.....	45.9	8.9	17.3	27.9	100.0
1958.....	46.3	8.6	17.9	27.2	100.0

TABLE 9. --Tobacco: Effects of different charges for operator and family labor, and land, on total cost of production with prevailing cost rates of other inputs and normal yield, tobacco-cotton farms, Coastal Plain, North Carolina, 1940-58

Year	Total cost per 100 pounds of tobacco with procedure -- ¹			
	4	6	7	8
	<u>Dollars</u>	<u>Dollars</u>	<u>Dollars</u>	<u>Dollars</u>
1940.....	16.66	28.75	37.09	25.42
1941.....	17.26	28.45	36.56	26.09
1942.....	18.93	28.26	36.05	27.72
1943.....	21.54	28.71	36.25	29.62
1944.....	23.18	28.31	35.57	30.00
1945.....	25.30	28.72	35.84	30.94
1946.....	27.56	29.01	35.97	32.76
1947.....	30.04	30.16	36.92	36.38
1948.....	32.35	32.36	39.19	39.75
1949.....	31.92	31.64	38.23	38.23
1950.....	32.11	31.69	38.20	38.38
1951.....	32.65	31.00	37.22	38.93
1952.....	34.24	31.60	37.67	39.51
1953.....	35.39	32.18	38.19	39.82
1954.....	38.27	35.14	41.13	43.75
1955.....	35.59	32.24	38.17	39.93
1956.....	38.21	33.94	39.90	42.20
1957.....	42.11	37.19	43.22	46.03
1958.....	42.90	37.58	43.56	46.50

¹ Procedure 4 includes operator and family labor charged at current wage rates of hired labor, and land at current values and rates of interest. Procedures 6, 7, and 8 include land charged at 1947-49 average rate, and operator and family labor charged as follows: Procedure 6- average wage rate, 1947-49; Procedure 7- average rate of return, 1947-49; Procedure 8- average rate of return, 1947-49, adjusted for changes in prices paid for commodities used in farm family living. A detailed description of procedures is given in table 1.

with cost assuming the unadjusted rate of return (procedure 7) was to lower cost in the beginning and raise it toward the end of the period.

The series of costs based on procedure 8 is on a considerably higher level than total cost calculated on the basis of assuming current wage rates, and current values of land and rates of interest, as the purchasing power of earnings was high in 1947-49 relative to the rest of the period.

The five procedures and assumptions used in computing the total cost of producing tobacco have resulted in estimates ranging from \$14.71 to \$37.09 per 100 pounds in 1940 and from \$37.58 to \$46.50 in 1958 (tables 5 and 9).

All these calculations emanated from a common approach, the chief characteristic of which was an enterprise-by-enterprise division of items of cost at a uniform rate per unit of a production item used. Hence, the cost of each enterprise was ascertained without regard to any other enterprise so far as value of the product produced was concerned. Granting the approach, however, most enterprises other than tobacco were operated with gross return falling short of total cost.

Residual Cost

Sales of tobacco average about 80 percent of cash income. Measured by the usual yardstick used to ascertain the importance of an enterprise, therefore, tobacco is

overwhelmingly the major enterprise in the area. This fact presents the opportunity to explore other methods of estimating the cost of producing tobacco, an opportunity that would not arise in calculations relating to minor enterprises.

On the basis of enterprise cost, under stated assumptions, the total cost of producing tobacco averaged about 50 percent of the aggregate cost of all enterprises on the farm (table 8). The cost of producing tobacco was substantially lower than its value in all years, whereas the cost of producing all other enterprises as a group exceeded the value of the products in all except 4 years of the 19-year period. These disparities indicate imperfections in this method of ascertaining the cost of supplementary enterprises. As pointed out previously, remedies that would include, among others, differential cost rates of resources, are conceivable. Because of lack of pertinent information, however, such remedies have no practical relevancy.

Calculating the cost of producing tobacco on the basis of aggregate cost of all enterprises on the farm less the value of minor enterprises has virtues, but also shortcomings. Its chief virtue is that distribution of each item of cost among the individual enterprises is obviated. Its main shortcoming is that all operator and family labor and all cropland are charged at uniform rates regardless of enterprise. This is also a shortcoming of the cost-by-enterprise approach. Whether charges for operator and family labor engaged in minor enterprises were too high or too low relative to the earning power of labor, they had no effect on the cost of producing tobacco. But in the residual-cost approach they do have an effect.

This procedure assumes that the cost of production of minor enterprises is equal to their value. In addition, all operator and family labor is charged at current wage rates of hired labor, and the land charge

is based on current values of land and rates of interest. Prevailing cost rates were used for other production items. The prevailing yield of tobacco per acre was used also (table 1, procedure 9).

Use of this procedure reveals that the ratio of cost of producing tobacco to aggregate cost was higher than that obtained by the enterprise-by-enterprise distribution of costs (table 1, procedure 3), except for 4 years--1941, 1942, 1944, and 1947 (table 10). It was only in these years that the combined value of products of supplementary enterprises exceeded their cost as ascertained by the enterprise-cost procedure, and therefore, brought about a lower cost of tobacco.

Total cost per pound of tobacco calculated by the residual method and the cost calculated by the enterprise method were very close from 1940 to 1948, but the spread between them has since widened (table 11). The increasing spread is a reflection of a deterioration in the relationship between cost and value of supplementary commodities.

Total cost of producing tobacco, computed by the residual method, was \$17.70 per 100 pounds in 1940 and \$51.90 in 1958. Prices received for tobacco exceeded total cost estimated by this method, in each year of the 19-year period except 1940 and 1957 (fig. 4). In these years, the value of tobacco plus that of other enterprises fell short of the aggregate cost.

The difference in cost of producing tobacco as calculated by the enterprise-cost and the residual methods is attributable to the same effect as if higher cost rates of resources, especially operator and family labor and land, had been used for tobacco than for other enterprises. Hence, the results are consistent with those that would have been expected if differential cost rates of resources had been used in the enterprise-cost method.

TABLE 10.--Tobacco: Total cost of production as a percentage of aggregate cost of all enterprises, with two procedures, tobacco-cotton farms, North Carolina, 1940-58

Year	Total cost of producing tobacco, as a percentage of aggregate cost of all enterprises, based on--		Year	Total cost of producing tobacco, as a percentage of aggregate cost of all enterprises, based on--	
	Enterprise cost	Residual cost ¹		Enterprise cost	Residual cost ¹
	Percent	Percent		Percent	Percent
1940.....	44.2	53.2	1950.....	50.7	63.8
1941.....	44.1	41.3	1951.....	51.5	53.1
1942.....	43.5	38.9	1952.....	51.3	61.2
1943.....	45.1	46.2	1953.....	50.8	65.2
1944.....	49.5	49.3	1954.....	53.2	67.9
1945.....	52.5	57.6	1955.....	53.2	67.5
1946.....	54.0	55.0	1956.....	51.1	63.6
1947.....	52.9	52.2	1957.....	45.9	66.5
1948.....	46.9	48.6	1958.....	46.3	60.2
1949.....	48.9	58.3			

¹ Aggregate cost of all enterprises less value of product of enterprises other than tobacco. A detailed description of residual cost is given in table 1, procedure 9.

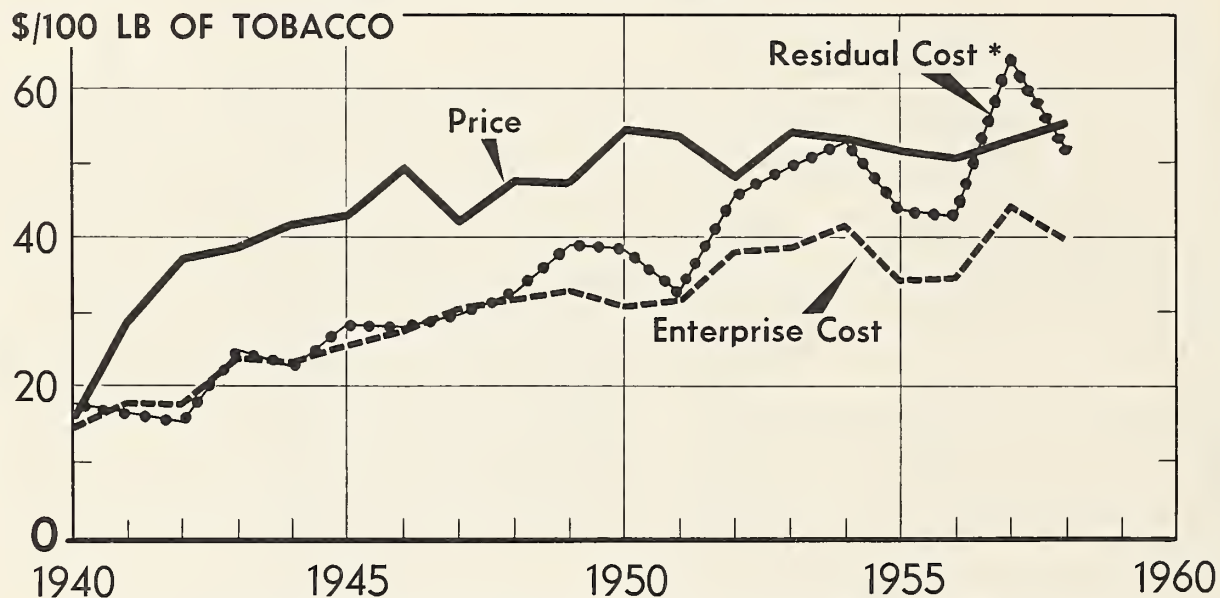
TABLE 11.--Tobacco: Total cost of production with two different procedures, tobacco-cotton farms, Coastal Plain, North Carolina, 1940-58

Year	Cost per 100 pounds		Year	Cost per 100 pounds	
	Enterprise cost	Residual cost ¹		Enterprise cost	Residual cost ¹
	Dollars	Dollars		Dollars	Dollars
1940.....	14.71	17.70	1950.....	30.57	38.51
1941.....	17.90	16.77	1951.....	31.61	32.64
1942.....	17.74	15.87	1952.....	38.19	45.62
1943.....	24.07	24.68	1953.....	38.76	49.72
1944.....	23.11	23.02	1954.....	41.56	52.99
1945.....	25.83	28.35	1955.....	34.48	43.71
1946.....	27.25	27.72	1956.....	34.51	42.92
1947.....	30.33	29.91	1957.....	44.34	64.22
1948.....	31.54	32.68	1958.....	39.99	51.90
1949.....	32.93	39.26			

¹ Aggregate cost of all enterprises less value of product of enterprises other than tobacco divided by production of tobacco. A detailed description of residual cost is given in table 1, procedure 9.

PRICE RECEIVED AND COST OF PRODUCTION

Tobacco—Cotton Farms, Coastal Plain, N. C.



* RESIDUAL COST AFTER DEDUCTING FROM AGGREGATE COST THE VALUE OF PRODUCTS OTHER THAN TOBACCO.

U.S. DEPARTMENT OF AGRICULTURE

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AGRICULTURAL RESEARCH SERVICE

Figure 4

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